

FARMERS' EXPENDITURES FOR CUSTOM PESTICIDE SERVICES, 1971

by Walter L. Ferguson

Economic Research Service • U.S. Department of Agriculture • Agricultural Economic Report No. 314



ABSTRACT

In 1971, farmers spent \$428 million for custom pesticide services in the United States; \$154 million were spent on application and the rest for pesticide materials. About 98 percent of the expenditures for custom services were for crops and the remainder were for livestock and other farm uses.

The largest expenditures for custom pesticide services were on corn and cotton, which together accounted for about 45 percent of the U.S. total for crops. The Pacific and Corn Belt regions accounted for over a third of the total for all crops. Farmers grossing over \$40,000 spent about 60 percent of the total expenditures on crops. Average expenditures per farm ranged from under \$450 for farmers grossing less than \$20,000 to about \$4,400 for those grossing \$100,000 or more.

Key Words: Pesticides, custom services, fungicides, herbicides, insecticides.

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PREFACE

In 1964, the Congress authorized an expanded program of research on the use of pesticides in agriculture. One phase of this program was a periodic farm survey to obtain information on the use of pesticides in different areas of the country and on different crops and classes of livestock. These data were to provide a basis for estimating the costs and benefits of pesticides and to serve as a measure of changes in pesticide use.

To meet the need for information, the Economic Research Service (ERS) obtained in early 1972 its third measure of the extent of pesticide use by farmers. The information on pesticide use for 1971 was gained as a part of the Statistical Reporting Service (SRS) 1971 Farm Production Expenditure Survey of about 8,600 farmers throughout the United States (excluding Alaska). Survey data were expanded to represent regional and U.S. expenditures for pest control on farms. Although the Farm Production Expenditure Survey is conducted annually, the pesticide use sections are included once every 5 years, approximately. Thus, they will next be included probably in 1977. Consequently, the data gathered for 1971 are the latest currently available for analysis.

The Standards and Research Division of SRS designed the nationwide sample from which farmers were selected for interviews. The Data Collection Branch of SRS helped develop the final format of the pesticide use sections in the Farm Production Survey questionnaire. The Branch also supervised the collection of the data through their State offices.

Special acknowledgement is made to the farmers who provided the data for the 1971 survey and whose cooperation made this report possible. Others contributing to the report include Theodore Eichers and Paul Andrienas of the National Economic Analysis Division, ERS.

This report is one of four being published on farm use of pesticides in 1971. Farmers' Use of Pesticides in 1971...Quantities, Agricultural Economic Report No. 252, was published in July 1974; Farmers' Use of Pesticides in 1971...Extent of Crop Use, Agricultural Economic Report No. 268, was published in September 1975. Farmers' Use of Pesticides in 1971...Expenditures, Agricultural Economic Report No. 296, will be published shortly.

SUMMARY

Farmers spent \$274 million for 143 million pounds of custom-applied pesticide material in 1971. Compared with 1964, expenditures increased 134 percent, and materials, 80 percent. An additional \$154 million was spent for application in 1971. Of the \$428 million total, 98 percent was spent on crops and the remainder on livestock and other farm uses.

Farmers spent \$274 million for custom-applied pesticide materials; about one-fourth of the total expenditures for farmer and custom-applied materials. About one-fourth of the materials used for crops and "other farm uses" was custom-applied, compared with only 3 percent for livestock.

Expenditures for custom application and materials on corn and cotton accounted for nearly half of the \$417 million total for crops.

In the Southeast, Delta States, Southern Plains, Mountain, and Pacific regions, one-half or more of the farmers using crop pesticides reported use of custom services. Farmers in these five regions made about 65 percent of all custom pesticide expenditures.

The use of custom pesticide service increases with size of farm. Only one-fourth of the farm operators grossing under \$2,500 who used pesticides employed custom services, compared with nearly half of those grossing \$40,000. Custom expenditures per farm ranged from about \$120 for farmers grossing less than \$2,500 to \$4,400 for farmers grossing \$100,000 or over.

Proposed changes in regulations concerning use of pesticides may bring some expansion to custom pesticide operations. Under the Federal Environmental Pesticide Control Act of 1972, pesticides classified in the more dangerous restricted use category may only be applied by or under the direct supervision of licensed applicators. Operators of large farms and custom pesticide applicators are most likely to meet the required standards for obtaining licenses. Others, including smaller farm operators, would need to purchase these services.

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INTRODUCTION

In 1971, custom-applied pesticide materials represented about one-fourth of U.S. farmers' expenditures for pesticide materials. Because custom pesticide operators are more effectively trained and regulated than farm operators and have more experience with pesticides, they have greater opportunity to influence their safe and effective use. And from an efficiency standpoint, custom operators may reduce the cost or increase the productivity of farm operations. These factors make it important for policymakers to be fully informed about the use of custom-applied pesticides. Then too, this information may help custom operators improve their services and enable farmers to make better use of them.

A major factor to be considered when deciding between ownership versus custom-hiring is the extent of high-cost equipment usage. Machinery cost decreases as the use of the machinery increases, because fixed costs are spread over more acres, hours, or units of use. With custom-hired services, however, the rate is usually fixed. Thus, for pesticide applications that require a minimal use of high cost equipment, custom services may be the most economical alternative. More specifically, factors to be considered include the amount of technical knowledge necessary, applicator skill¹ and cost of specialized equipment, availability of farm labor, timeliness of operation, and quality of work.

METHODOLOGY

The 1964 and 1966 data were obtained from Farmers Expenditures for Custom Pesticide Service in 1964, AER-146, Economic Research Service, Oct. 1968, and Farmers' Use of Custom Applied Pesticides in 1966 (unpublished), both of which were based on enumerative surveys. For 1971, pesticide use information was gathered as part of a nationwide survey that obtained farmers production expenditures. Approximately 8,600 farmers were interviewed in 394 counties throughout the 48 contiguous States and Hawaii (fig. 1).

Selection of farmers for interview was based on a two-stage multiple-frame sample designed to represent all farms in the United States. The first stage of sampling consisted of the selection of counties or groups of counties. These formed the primary sampling units. In the second stage of sampling, farms were chosen within each primary sampling unit.

All data were expanded by a factor unique to each primary sampling unit and crop. Pesticide use data for crops were further adjusted by a factor

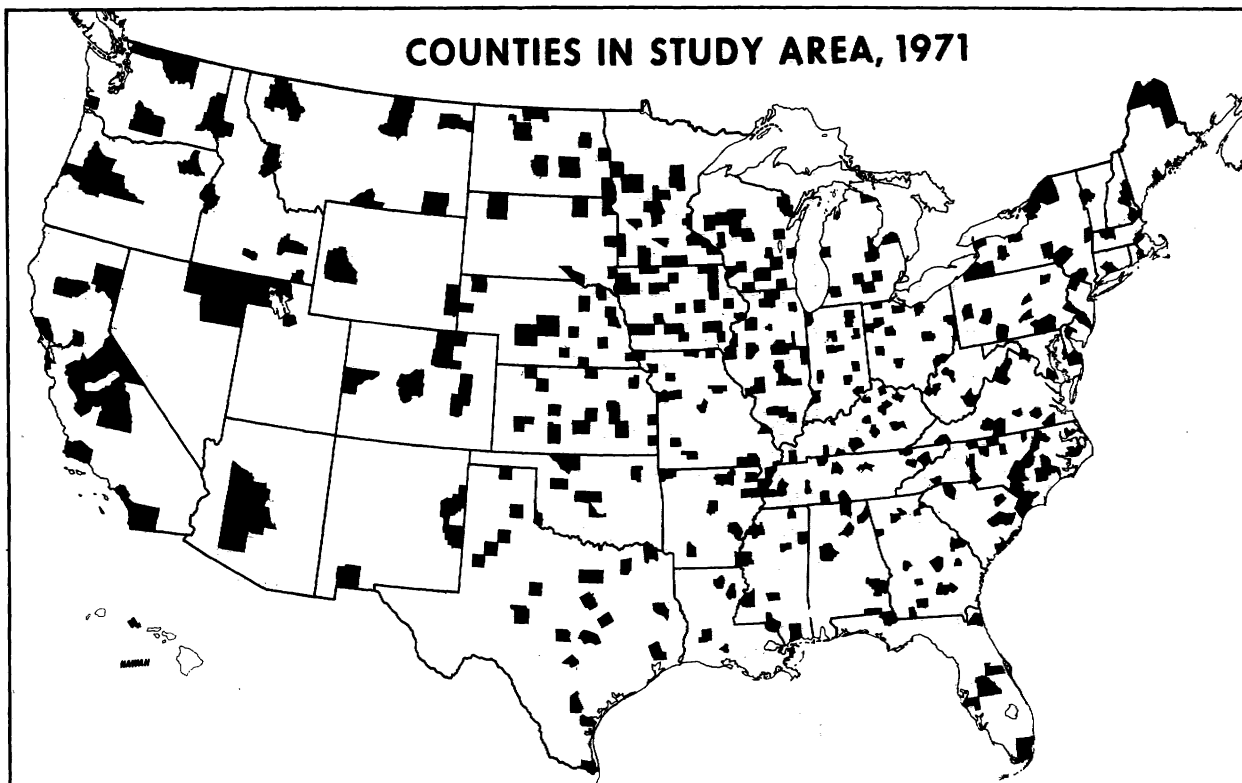


Figure 1

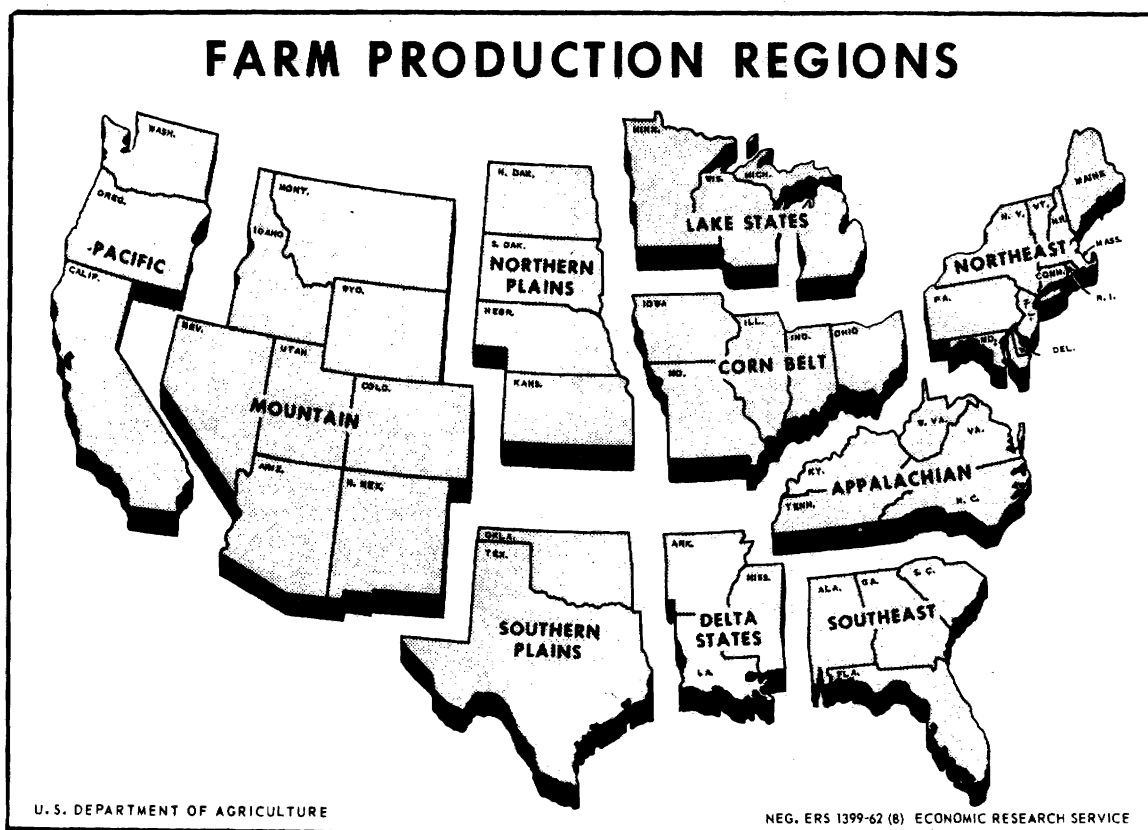


Figure 2

that reflected the ratio of the number of acres of each crop grown in a production region (fig. 2) to the number of expanded sample acres of each crop grown on sample farms. Each of 22 classes of crops had an individual adjustment factor for each of the 10 production regions.

Custom pesticide services were classified as those hired for any pesticide spraying or dusting of crops, livestock, and for other farm uses. Other farm uses included pesticides used for seed and stored crops, buildings, seed beds and transplants, and miscellaneous noncrop uses. Data on expenditures for custom services in 1971 included both the cost of application and the cost of pesticide materials.

Pesticides refer to insecticides, herbicides, fungicides, nematocides, miticides, soil sterilants, and other chemical formulations for controlling farm pests, and for certain crop growth regulation purposes. Not included are disinfectants, medicines and other materials taken internally by livestock, and pesticides for lawn, garden, and home use. Custom pesticide services that were part of an organized local, State, or Federal pest control program not paid for directly by the farmer are not covered in this report.

EXPENDITURES FOR CUSTOM PESTICIDE MATERIALS AND SERVICES ARE RISING 1/

In 1971, farmers paid about \$274 million for 143 million pounds of custom-applied pesticide materials, a 134-percent increase over 1964 expenditures, and nearly an 80-percent increase over the quantity used in 1964 (table 1). 2/ The cost of custom-applied pesticide materials increased from about \$1.50 per pound in 1964 to about \$1.90 in 1971, largely because many of the chemicals used in 1971 were more complex and target-specific than those used in 1964.

In 1971, crops accounted for about 98 percent of the \$428 million spent for custom application and materials. The remainder went for livestock and other farm uses (table 2). Average expenditures per farm for custom pesticide services amounted to \$896; \$793 was for crops, \$85 for livestock, and \$18 for other farm uses.

Based on expenditures, the proportion of custom-applied materials increased to 27 percent in 1971 from 23 percent in 1964 and 25 percent in 1966 (table 3). 2/

In each of the three survey years, expenditures for crop treatment accounted for over 95 percent of the expenditures for custom-applied materials.

1/ Expenditures for custom pesticide services are defined as including application charges and material costs. Total pesticide material expenditures are defined as including costs for farmer- and custom-applied materials.

2/ In deriving amounts, it was assumed that the ratio of the amount of custom-applied pesticide materials to total materials was the same as that of expenditures for custom-applied materials to total material expenditures by farmers.

Table 1.--Expenditures for custom-applied pesticide materials and amounts used, 1964, 1966, and 1971 1/

Year	Expenditures for custom-applied pesticide materials		Custom-applied pesticide materials used <u>2/</u>		Cost of custom-applied pesticide materials	
	Million dollars	Percent of 1964	Million dollars	Percent of 1964	Dollars per pound	Percent of 1964
1964	117	100	80	100	1.46	100
1966	139	119	88	110	1.58	108
1971	274	234	143	179	1.92	132

1/ Excludes Alaska and Hawaii in 1964 and 1966 and excludes Alaska in 1971.

2/ In deriving amounts, it was assumed that the ratio of the amount of custom-applied pesticide materials to total materials was the same as that of expenditures for custom-applied materials to total materials expenditures by farmers.

Table 2.--Total and per-farm expenditures for custom pesticide services for crops, livestock, and other farm uses, 1971 1/

Category	Custom expenditure for--			Expenditures per farm reporting custom pesticide services for--		
	Applying pesticide	Applied : pesticide materials:	Total	Applying pesticide	Applied : pesticide materials:	Total
	--- 1,000 dollars ---			--- Dollars ---		
Crops	148,975	268,378	417,353	290	503	793
Livestock	1,859	1,112	2,971	53	32	85
Other farm uses <u>2/</u>	3,356	4,127	7,483	8	10	18
Total	154,190	273,617	427,807	351	545	896

1/ Excludes Alaska.

2/ Seed and stored crops, buildings, seed beds and transplants, and miscellaneous noncrop uses.

Table 3.--Expenditures for total farm pesticide materials and for custom-applied materials, 1964, 1966, and 1971 1/

Category	Pesticide expenditures						Proportion of		
	Total	Custom-	Total	Custom-	Total	Custom-	total expenditures		
	:applied:		:applied:		:applied:		custom-applied		
	: 1964	: 1966	: 1964	: 1966	: 1964	: 1966	: 1964	: 1966	: 1971
	---- Million dollars ----						--- Percent ---		
Crops	432	113	506	133	943	268	26	26	28
Livestock	63	2	29	2	44	1	3	7	3
Other uses	26	<u>2/3</u>	26	4	15	4	12	15	27
United States <u>3/</u>	521	118	561	139	1,002	274	23	25	27

1/ Excludes Alaska. Does not include cost of application.

2/ Pesticide expenditures for other uses (seed, stored crops, buildings, seed beds, transplants, miscellaneous noncrop uses) were not obtained in the survey of 1964. Assumes 1964 expenditures for "other use" materials in same proportion of custom expenditures for crops and livestock as in 1966.

3/ Total may not agree with details because of rounding.

In 1971, nearly 30 percent of the total pesticide material expenditures for crops and "other farm uses" went for custom-applied materials, while only 3 percent went for livestock (table 4).

The chief reasons that crops have a higher proportion of expenditures for custom-applied materials include: (1) livestock are physically more adaptable to farmer rather than custom treatment, (2) some machines required for crop applications are complex and costly for farmers to own, and (3) crops may require less frequent treatment than livestock. Hence, there is less economic justification for crop farmers to own the equipment.

For "other farm uses" of pesticides, 27 percent of the total expenditures were for custom-applied materials in 1971.

These data understate the importance of custom services for "other farm uses." Whereas expenditures for rodent, bird, and other predator control are included in total expenditures, custom expenditures data for these purposes were not obtained. Since material expenditures for predator control doubtlessly include some custom-applied materials, the percentage custom-applied is therefore slightly understated.

Expenditures for custom materials were 95 percent of total pesticide expenditures for rice. Custom material expenditures for alfalfa and wheat were over 60 percent of the respective total material expenditures. The equipment needed for pesticide application on these crops require substantial operator skill and capital investment. Flooding of fields and the many ditches and canals prevent use of ground rigs in rice fields, and therefore require aerial applications, usually custom. And since wheat in the later stages of

Table 4.--Expenditures for custom-applied pesticide materials compared with total expenditures for pesticide materials used on crops, livestock, and other farm usage, 1971 ^{1/}

Category	Total expenditures for materials ^{2/}	Expenditures for custom-applied pesticide materials	Proportion of total pesticide expenditures custom-applied
	<u>1,000 dollars</u>	<u>1,000 dollars</u>	<u>Percent</u>
Crops:			
Corn	325,268	72,843	22
Cotton	132,217	51,324	39
Wheat	20,063	12,419	62
Sorghum	38,748	20,444	53
Rice	17,009	16,160	95
Other grains ^{3/}	9,196	3,955	43
Soybeans	138,088	24,455	18
Tobacco	17,966	1,631	9
Peanuts	38,702	12,929	33
Sugar beets	14,611	3,944	27
Other field crops ^{3/}	17,015	5,425	32
Alfalfa	6,795	4,296	63
Other hay and forage ^{3/}	578	219	38
Pasture	8,429	2,212	26
Irish potatoes	17,862	3,701	21
Other vegetables	39,334	13,849	35
Citrus	21,449	9,197	43
Apples	24,617	193	1
Other deciduous fruits ^{3/}	23,229	2,294	10
Other fruits and nuts ^{3/}	24,327	5,729	24
Nursery and greenhouse ...	5,429	175	3
Summer fallow	2,219	986	44
All crops	943,151	268,380	28
Livestock:			
Dairy	11,629	195	2
Beef cattle	23,285	720	3
Hogs	4,965	53	1
Sheep	336	20	6
Poultry	2,672	59	2
Other livestock	1,063	65	6
All livestock	44,150	1,112	3
Other farm usage:			
Seed and stored crops	6,069	1,388	23
Buildings	958	37	4
Seedbeds and transplants .	4,941	1,738	35
Other noncrop usage	3,235	964	30
Total other uses	15,203	4,127	27
All uses	1,002,504	273,619	27

^{1/} Excludes Alaska. ^{2/} Does not include cost of applying pesticides. ^{3/} Crops included in this category are listed in the appendix.

Table 5.--Expenditures for custom-applied pesticide materials compared with total expenditures for pesticide materials, all farm uses, by regions, 1971 ^{1/}

Region	Total expenditures for pesticide materials	Expenditures for custom-applied pesticide materials	Proportion of total pesticide expenditures
	--- 1,000 dollars ---		--- Percent ---
Northeast	49,675	3,543	7
Lake States	99,856	17,233	17
Corn Belt	283,718	54,800	19
Northern Plains	86,205	22,321	26
Appalachian	71,292	11,134	16
Southeast	113,433	36,251	32
Delta	85,519	30,636	36
Southern Plains	71,134	34,911	49
Mountain	30,902	13,281	43
Pacific	110,770	49,509	45
United States	1,002,504	273,619	27

^{1/} Excludes Alaska. Excludes cost of applying pesticides.

Table 6.--Extent and cost of custom pesticide services for crops, 1964, 1966, and 1971 ^{1/}

Year	Farms reporting pesticide use ^{2/}	Farms reporting custom pesticide services ^{3/}	Farms reporting custom pesticide services ^{3/}	Total custom expenditure for-- ^{4/}	Expenditures per farm reporting expenditures for--	Expenditures per farm reporting expenditures for--	Expenditures per farm reporting expenditures for--	Expenditures per farm reporting expenditures for--
	Percent	Percent	Percent	Million dollars	Dollars	Dollars	Dollars	Dollars
1964...	73	32	58.9	112.9	171.8	152	220	372
1966...	52	35	71.6	133.0	204.6	129	201	330
1971...	55	39	149.0	268.4	417.4	290	503	793

^{1/} Excludes Alaska and Hawaii in 1964 and 1966 and excludes Alaska in 1971.

^{2/} Survey farms using pesticides as a percentage of survey farms growing the crop.

^{3/} Survey farms reporting custom application services as a percentage of farms reporting pesticide use.

^{4/} Estimated expenditures for all farms in the 49 States.

Table 7.--Extent and cost of custom pesticide services for crops, by crop category, 1971 1/

Category	Farms reporting pesticide use <u>2/</u>	Farms reporting custom pesticide service <u>3/</u>	Custom expenditures for-- <u>4/</u>			Expenditures per farm reporting custom expenditures for--		
			Applying pesticides	Applied pesticide material	Total	Applying pesticides	Applied pesticide material	Total
	--- Percent ---		--- 1,000 dollars ---			---- Dollars ----		
Corn	68	33	27,260	72,843	100,103	106	283	389
Cotton	86	51	35,300	51,324	86,624	784	1,140	1,924
Wheat	23	47	13,858	12,419	26,277	257	230	487
Sorghum	52	53	16,017	20,444	36,461	312	398	710
Rice	91	100	5,612	16,160	21,772	526	1,514	2,040
Other grain <u>5/</u>	20	32	4,848	3,955	8,803	110	90	200
Soybeans	63	22	9,239	24,455	33,694	127	336	463
Tobacco	90	18	921	1,631	2,552	25	44	69
Peanuts	86	49	4,329	12,929	17,258	195	583	778
Sugarbeets	86	33	1,900	3,944	5,844	358	743	1,101
Other field crops <u>5/</u>	29	34	3,169	5,425	8,594	237	405	642
Alfalfa	7	47	2,836	4,296	7,132	144	218	362
Other hay and forage	2	24	157	219	376	40	56	96
Pasture	5	10	1,763	2,212	3,975	217	273	490
Irish potatoes	78	19	2,579	3,701	6,280	931	1,340	2,271
Other vegetables <u>5/</u>	69	20	5,849	13,849	19,698	510	1,208	1,718
Citrus	67	70	8,534	9,197	17,731	680	733	1,413
Apples	84	7	128	193	321	93	141	234
Other deciduous fruit <u>5/</u> ..	84	14	956	2,294	3,250	356	855	1,211
Other fruits and nuts <u>5/</u> ..	65	33	3,131	5,729	8,860	321	588	909
Nursery and greenhouse	68	3	170	175	345	422	434	856
Summer fallow	4	18	419	986	1,405	191	450	641
All crops	55	39	148,975	268,380	417,355	290	503	793

1/ Excludes Alaska.2/ Survey farms using pesticides on specified crops as a percentage of survey farms growing the crop.3/ Survey farms reporting custom application services as a percentage of farms reporting pesticide use.4/ Estimated expenditures for all farms in the 49 States.5/ Crops included in this category are listed in the appendix.

growth could be seriously injured by spray rigs moving through the fields, aerial applications are used to avoid crop loss.

In 1971, livestock farmers' expenditures for custom pesticide materials ranged from 1 percent of the total material expenditures for hogs to 6 percent for sheep. Cattle and hogs are generally treated by the farmer. These livestock are usually treated often, and complex equipment is not required. Therefore, the cost per treatment generally does not justify custom services.

The Northeast region had the smallest share of expenditures for pesticide materials applied by custom operators--7 percent, while the Southern Plains, Mountain, and Pacific regions had the largest--43 to 49 percent (table 5). Type of enterprise and size of farm are the major reasons for this difference. The large number of dairy farms in the Northeast and Lake States regions and the generally smaller, widely dispersed diversified farms of the Appalachian region provide little incentive for custom service. Conversely, the large-scale, extensive crop production in the southern and western areas is more conducive to custom services.

Custom Pesticide Services Used Primarily on Crops

In 1971, over \$417 million was spent for custom pesticide services to control crop pests, an average of \$783 per farm. About one-third was for application and two-thirds for materials--\$290 and \$503, respectively (table 6).

The percentage of farmers reporting use of pesticides on crops appears to have decreased between 1964 and 1971. However, this decrease is chiefly due to improved sampling of farmers in the lower sales classes, who generally use fewer pesticides. While the improved samples of 1966 and 1971 indicated lower percentages of farmers using pesticides, the percentage of farmers using custom services increased from 32 percent in 1964 to 35 percent in 1966 and 39 percent in 1971.

Corn and cotton accounted for the largest expenditures for custom pesticide services, about 45 percent of the total for all crops in 1971 (table 7). While custom service expenditures for cotton in 1971 increased only slightly over 1964, the increased use of herbicides on corn in 1971 over 1964 accounted for the considerable increase in custom service expenditures for this crop. 3/

3/ Custom pesticide material expenditures for corn increased by \$64 million in 1971 over 1964, while custom material expenditures for cotton increased by only \$7 million.

Herbicides and insecticides accounted for 99 percent of the pesticides used on corn in 1971. Comparing total pesticide use on corn (farmer-applied and custom-applied) in 1971 with use in 1964, there were 86 million more pounds of herbicides used on corn in 1971 compared with only 10 million more pounds of insecticides. Thus, it is clear that the substantial increase in use of herbicides on corn chiefly accounts for the increased custom pesticide expenditures for this crop.

Source: Robert Jenkins, et. al, Farmers' Expenditures for Custom Pesticide Services in 1964, Agr. Econ. Rep. 146, Econ. Res. Serv.; Theodore Eichers, et. al, Quantities of Pesticides Used by Farmers in 1964, Agr. Econ. Rep. 131, Econ. Res. Serv., and Paul Andrienas, Farmers' Use of Pesticides in 1971, Agr. Econ. Rep. 252, Econ. Res. Serv.

Cotton, rice, and potato growers had the larger custom pesticide expenditures; about \$2,000 per farm. Aerial application, usually done by custom operators, is important for cotton and rice. Other reasons for the large custom expenditures are likely due to: (1) the large acreages of these crops usually grown per farm, (2) need for repeated application, and (3) high cost of some pesticides used. Other farms spending over \$1,000 per farm for custom services included those on which the major crops grown were sugarbeets, citrus, vegetables (not including Irish potatoes), and deciduous fruits (not including apples).

For farms employing custom pesticide services, corn was the largest custom service expenditure (\$100 million), yet one of the smallest average expenditures (\$389) on a per farm basis. The large total for custom pesticide expenditures reflects the large number of farms growing corn and the widespread use of custom services on corn.

The larger regional expenditures for custom pesticide services were in the Pacific and Corn Belt regions. Expenditures for both regions totaled a third of the \$417 million U.S. outlay for crops (table 8). The large amounts spent on custom services in the Corn Belt can be attributed primarily to pesticides used for corn and soybeans. In the Pacific region, primary custom pesticide services were used for fruits, vegetables, and cotton.

One-half or more of the farmers using pesticides in the Southeast, Delta States, Southern Plains, Mountain, and Pacific regions used custom services. Farmers in the five regions (21 States) accounted for about 65 percent of total expenditures for custom pesticide services in the United States. The average spent per farm in these regions varied from \$950 to \$2,500.

Of farmers using pesticides in 1971, only 25 percent of those grossing under \$2,500 employed custom services compared with about half of those grossing \$50,000 or over (table 9). Farmers grossing \$40,000 or over accounted for about 60 percent of the expenditures for custom pesticide services. Average annual expenditures per farm ranged from about \$120 for farmers grossing less than \$2,500, to \$4,400 for those grossing \$100,000 or more.

Costs Per Acre Vary Widely by Crop

The factors that determine custom pesticide cost per acre include the number of applications involved, cost of materials, purchase price of application equipment, technical knowledge required, and size of fields. The average cost of using custom services for pesticide application and materials ranged from about \$1.90 per acre for spraying wheat using fixed wing aircraft to about \$11.00 per acre for spraying tobacco with ground equipment (table 10).

Per acre costs by crop for application and for materials are shown separately in tables 11 and 12, respectively, and per acre costs of custom

Table 9.--Extent and cost of custom pesticide services for crops by gross sales, 1971 1/

Gross sales of farms	: Farms : reporting : pesticide : use <u>2/</u>	: Farms : reporting : custom : pesticide : services <u>3/</u>	: Custom expenditures for-- <u>4/</u>			: Expenditures per farm reporting : custom pesticide services for--		
			: Applying : pesticides	: Applied : pesticide	: Total <u>5/</u> : materials:	: Applying : pesticides	: Applied : pesticide	: Total <u>5/</u> : materials:
			--- <u>Percent</u> ---	--- <u>1,000 dollars</u> ---		--- <u>Dollars</u> ---		
Less than \$2,500 ...	26	25	2,288	5,037	7,325	38	83	121
\$2,500-\$4,999	51	40	4,120	8,040	12,160	71	139	210
\$5,000-\$9,999	64	36	6,114	11,614	17,728	95	180	275
\$10,000-\$19,999 ...	79	41	16,753	29,549	46,302	162	285	447
\$20,000-\$39,999 ...	84	40	28,585	48,317	76,902	260	440	700
\$40,000-\$99,999 ...	86	49	50,813	99,455	150,269	545	1,066	1,611
\$100,000 or more ...	84	49	40,302	66,367	106,669	1,650	2,717	4,367
All classes	55	39	148,975	268,380	417,355	290	503	793

1/ Excludes Alaska.

2/ Survey farms using pesticides on any crop as a percentage of survey farms growing crops.

3/ Survey farms reporting custom pesticide services as a percentage of farms reporting pesticide use on any crop.

4/ Estimated expenditures for all farms in the 49 States.

5/ Totals may not agree with details because of rounding.

Table 10.--Expenditures per acre for custom pesticide services (application and materials) by crop category and by form of pesticide with specified types of equipment, 1971 ^{1/}

Crop category	Applied with ground equipment					Applied with aircraft					
						Fixed wing				Helicopter	
	Dust	Spray	Granular	Mixed with fertilizer	Other <u>2/</u>	Dust	Spray	Granular	Other <u>2/</u>	Dust	Spray
--- Dollars ---											
Corn	3.71	4.78	4.37	5.22	4.79	4.08	4.23	3.57	.64	4.75	3.33
Cotton	18.14	5.23	7.55	5.39	12.75	8.79	6.50	18.18	3.20	--	8.85
Wheat	--	1.68	2.46	1.75	--	3.19	1.91	4.47	--	--	1.20
Sorghum	5.24	3.69	3.93	6.01	--	5.30	2.58	4.08	--	--	2.46
Rice	--	6.50	--	--	1.91	--	6.47	10.58	4.42	--	3.65
Other grains <u>3/</u>	--	1.88	2.17	1.53	1.30	3.65	1.88	4.54	--	--	1.31
Soybeans	19.60	5.81	6.06	9.96	3.12	5.36	3.27	12.65	1.12	--	2.68
Tobacco	8.91	10.68	--	20.00	--	11.12	16.54	--	--	--	--
Peanuts	6.85	6.29	6.15	--	--	8.22	13.49	6.76	--	--	20.66
Sugarbeets	3.68	9.99	9.05	--	21.94	13.73	6.77	3.96	7.28	--	4.49
Other field crops <u>3/</u>	5.40	6.06	3.65	2.69	--	4.27	5.17	5.76	--	--	4.37
Alfalfa	2.80	4.14	3.92	--	5.26	--	4.44	4.90	--	--	5.65
Other hay and forage <u>3/</u>	--	2.98	--	--	--	--	1.83	--	--	--	--
Pasture	--	2.23	--	.18	--	--	2.87	.20	--	--	3.40
Potatoes	--	11.20	18.51	17.07	29.55	5.17	34.41	--	--	--	7.86
Other vegetables <u>3/</u>	11.97	8.40	3.58	9.55	21.88	6.55	8.03	9.78	--	19.23	9.45
Citrus	8.30	9.86	10.27	--	5.74	--	11.19	--	--	--	9.92
Apples	--	8.37	--	--	--	--	4.75	--	--	--	8.99
Other deciduous fruit <u>3/</u> ...	3.65	9.52	--	--	--	47.48	12.29	--	--	19.83	12.61
Other fruits and nuts <u>3/</u> ...	8.92	9.64	6.98	7.53	68.59	17.21	9.41	9.47	--	6.15	6.31
Nursery and greenhouse	--	--	--	--	--	--	--	--	--	--	--
Summer fallow	--	2.95	--	--	--	--	4.67	--	--	--	--
All crops	10.35	4.76	5.79	5.62	10.11	8.81	3.81	4.64	4.27	8.47	4.84

-- = None reported.

^{1/} Alaska excluded.

^{2/} Includes foams, strips, baits, rubs, and so forth.

^{3/} Crops included in this category are listed in the appendix.

Table 11.--Expenditures per acre for custom pesticide application (not including materials) by crop category and by form of pesticide with specified type of equipment, 1971 1/

Crop category	Applied with ground equipment					Applied with aircraft					
	Dust	Spray	Granular	Mixed with fertilizer	Other <u>2/</u>	Fixed wing				Helicopter	
						Dust	Spray	Granular	Other <u>2/</u>	Dust	Spray
						--- Dollars ---					
Corn .....	.94	1.17	1.11	.74	1.59	1.53	1.56	1.34	.18	2.11	1.82
Cotton	2.46	1.81	5.47	.47	3.25	3.23	2.72	8.38	.70	--	3.47
Wheat	--	.80	1.00	1.19	--	1.18	1.06	1.90	--	--	.72
Sorghum	2.23	1.17	1.25	.86	--	1.95	1.32	1.41	--	--	1.54
Rice	--	1.94	--	--	.91	--	1.75	1.04	2.50	--	3.01
Other grains <u>3/</u>	--	.98	1.01	.95	--	1.32	1.10	1.92	--	--	.83
Soybeans	4.00	1.19	1.40	1.13	1.25	1.45	1.25	5.90	.16	--	1.39
Tobacco	4.14	3.39	--	10.00	--	3.89	9.22	--	--	--	--
Peanuts	1.92	1.15	1.11	--	--	2.36	3.85	1.24	--	--	3.26
Sugarbeets	1.05	2.09	2.16	--	4.11	6.34	3.67	2.56	1.65	--	3.23
Other field crops <u>3/</u>	2.00	1.69	1.21	1.49	--	1.46	2.06	1.78	--	--	1.45
Alfalfa	2.00	1.46	1.12	--	1.55	--	1.85	2.00	--	--	2.13
Other hay and forage <u>3/</u>	--	1.07	--	--	--	--	1.02	--	--	--	--
Pasture	--	1.14	--	--	--	--	1.18	.05	--	--	2.56
Irish potatoes	--	3.22	3.11	6.57	4.74	2.04	3.37	--	--	--	2.78
Other vegetables <u>3/</u>	2.13	2.49	1.26	3.82	2.68	2.43	2.37	2.82	--	4.36	4.11
Citrus	3.42	4.93	2.70	--	2.87	--	4.35	--	--	--	3.54
Apples	--	2.78	--	--	--	--	1.92	--	--	--	5.15
Other deciduous fruit <u>3/</u> ..	1.00	2.87	--	--	--	5.64	6.31	--	--	8.91	7.61
Other fruits and nuts <u>3/</u> ..	4.79	3.09	2.05	1.98	16.71	5.17	3.92	4.00	--	3.32	3.58
Nursery and greenhouse	--	--	--	--	--	--	--	--	--	--	--
Summer fallow	--	.78	--	--	--	--	1.59	--	--	--	--
All crops	2.56	1.43	1.74	.91	2.04	2.57	1.75	1.53	1.01	2.99	2.20

-- = None reported.

1/ Excludes Alaska.

2/ Includes foams, strips, baits, rubs, and so forth.

3/ Crops included in this category are listed in the appendix.

Table 12.--Expenditures per acre for custom-applied pesticide materials (not including application cost) by crop category and by form of pesticide with specified type of equipment, 1971 ^{1/}

Crop category	Applied with ground equipment					Applied with aircraft					
						Fixed wing				Helicopter	
	Dust	Spray	Granular	Mixed with fertilizer	Other <u>2/</u>	Dust	Spray	Granular	Other <u>2/</u>	Dust	Spray
--- Dollars ---											
Corn	2.77	3.61	3.26	4.48	3.20	2.55	2.67	2.23	.46	2.64	1.51
Cotton	15.68	3.42	2.08	4.92	9.50	5.56	3.78	9.80	2.50	--	5.38
Wheat	--	.88	1.46	.56	--	2.01	.85	2.57	--	--	.48
Sorghum	3.10	2.52	2.68	5.15	--	3.35	1.26	2.67	--	--	.92
Rice	--	4.56	--	--	1.00	--	4.72	9.54	1.92	--	.64
Other grains <u>3/</u>	--	.90	1.16	.58	1.30	2.33	.78	2.62	--	--	.48
Soybeans	15.60	4.62	4.66	8.83	1.87	3.91	2.02	6.75	.96	--	1.29
Tobacco	4.77	7.29	--	10.00	--	7.23	--	--	--	--	--
Peanuts	4.93	5.14	5.04	--	--	5.86	9.64	5.52	--	--	17.40
Sugarbeets	2.63	7.90	6.89	--	17.83	7.39	3.10	1.40	5.63	--	1.26
Other field crops <u>3/</u>	3.40	4.37	2.44	1.20	--	2.81	3.11	3.98	--	--	2.92
Alfalfa .....	.80	2.78	2.80	--	3.71	--	2.59	2.90	--	--	3.52
Other hay and forage <u>3/</u>	--	1.91	--	--	--	--	.81	--	--	--	--
Pasture	--	1.09	--	.18	--	--	1.69	.15	--	--	.84
Irish potatoes	--	7.98	15.40	10.50	14.81	3.13	3.18	--	--	--	5.08
Other vegetables <u>3/</u>	9.84	5.91	2.32	5.72	19.20	4.12	5.66	6.96	--	14.87	5.34
Citrus	4.88	4.93	7.57	--	2.87	--	6.84	--	--	--	6.38
Apples	--	5.59	--	--	--	--	2.83	--	--	--	3.84
Other deciduous fruit <u>3/</u> ..	2.65	6.65	--	--	--	41.84	5.98	--	--	10.92	5.00
Other fruits and nuts <u>3/</u> ..	4.13	6.55	4.93	5.55	51.88	12.04	5.49	5.47	--	2.83	2.73
Nursery and greenhouse	--	--	--	--	--	--	--	--	--	--	--
Summer fallow	--	2.17	--	--	--	--	3.08	--	--	--	--
All crops	7.79	3.33	4.05	4.71	8.07	5.61	2.06	3.11	3.25	5.47	2.64

-- = None reported.

^{1/} Excludes Alaska.

^{2/} Includes foams, strips, baits, rubs, and so forth.

^{3/} Crops included in this category are listed in the appendix.

services are shown by region in table 13. The cost of applying pesticides as sprays ranged from about \$.80 per acre using ground equipment on wheat and summer fallow to over \$9.00 per acre for spraying tobacco with fixed wing aircraft. Materials costs for sprays applied with ground equipment ranged from about \$.90 per acre for wheat to \$7.00-\$8.00 for tobacco, sugarbeets, and potatoes.

For both ground equipment and fixed wing aircraft, total costs for applying either sprays or dusts were higher in the Southeast and Pacific regions. The large acreages of cotton, vegetables, and fruits account for the higher costs of custom services in these regions.

Fixed Wing Aircraft Apply Most Custom Pesticide Materials

Fixed wing aircraft accounted for 69 percent of farmers expenditures for custom pesticide equipment services in 1964 and 63 percent in 1971 (table 14). 4/ Ground equipment accounted for 30 percent in 1964 compared with 35 percent in 1971. Application by helicopter is still minimal, accounting for 1 percent in 1964 and 2 percent in 1971.

Custom application by fixed-wing aircraft, particularly important for cotton and rice, accounted for 87 and 99 percent, respectively, of the expenditures for these two crops. For cotton, large and sometimes wet fields, timeliness of application, and lower cost per acre are important factors causing preference for fixed-wing aircraft over ground equipment. For rice fields, which are flooded most of the growing season, pesticides can be most feasibly distributed by airplane.

Ground equipment is extensively used for tobacco, fruits, and vegetables which generally require many applications of pesticides and are frequently grown on small plots.

In terms of regional expenditures, fixed-wing aircraft applied about 85 percent of custom pesticide materials in the Southern Plains and Mountain States and 97 percent in the Delta States (table 15). Large acreages of cotton and rice accounted for much of the use of fixed-wing aircraft in these regions. Aircraft applied about 70 percent of custom pesticides in the Northern Plains region, where small grains are grown on large level tracts of land.

The larger proportions of custom material expenditures for helicopter services were in the Northeast, Lake States, and Pacific regions. Helicopters are especially adapted for precision application of pesticides on fruit trees or vegetable crops grown on small plots in these regions.

The use of fixed-wing aircraft to custom apply pesticides increases with farm sales. As indicated by expenditures for pesticide application, nearly

4/ Jenkins, Robert, Theodore Eichers, Paul Andrienas, and Austin Fox, Farmers' Expenditures for Custom Pesticide Service in 1964, U.S. Dept. of Agr., Econ. Res. Serv., Agr. Econ. Rep. 192, October 1968.

Table 13.--Expenditures per acre for custom pesticide service (application and materials) for all crops, by region and form of pesticide applied with specified type of equipment, 1971 1/

Region	Applied with ground equipment					Applied with aircraft				
						Fixed wing				Helicopter
	Dust	Spray	Granular	Mixed with fertilizer	Other <u>2/</u>	Dust	Spray	Granular	Other <u>2/</u>	Dust : Spray
--- Dollars ---										
Northeast	--	4.91	3.92	5.82	30.00	--	4.13	--	--	4.01 4.49
Lake States	4.08	4.12	5.66	6.13	--	5.87	4.10	5.05	--	6.23 6.13
Corn Belt	5.90	5.17	4.66	5.13	3.12	2.20	4.89	3.98	--	3.25 3.13
Northern Plains	--	2.18	2.54	7.65	11.50	--	2.22	3.24	--	-- 1.04
Appalachian	4.44	6.34	6.55	7.08	--	5.69	5.22	6.09	--	-- 16.46
Southeast	12.11	7.16	7.82	5.60	5.74	10.17	9.05	2.81	--	-- 4.93
Delta States	5.87	4.68	7.93	--	1.91	2.97	5.15	11.89	1.12	-- 6.29
Southern Plains	5.06	3.50	3.93	--	--	6.11	3.85	4.25	3.20	-- 5.93
Mountain	3.60	3.10	5.14	--	7.24	5.82	3.42	4.25	--	5.40 3.17
Pacific	9.42	7.86	7.25	5.56	16.47	8.54	5.60	5.98	6.26	15.45 6.26
All Regions	10.35	4.76	5.79	5.62	10.11	8.18	4.32	4.64	4.27	8.46 4.84

-- = None reported.

1/ Excludes Alaska.

2/ Includes foams, strips, baits, rubs, and so forth.

Table 14.--Percentage distribution, by crop category, of farms using custom pesticide services and of expenditures for application charges (not including materials) by type of applicator equipment, 1971 1/

Crop category	Type of equipment					
	Ground (surface)		Fixed wing aircraft		Helicopter	
	Farms	Custom	Farms	Custom	Farms	Custom
	reporting <u>2/</u>	expenditures <u>3/</u>	reporting <u>2/</u>	expenditures <u>3/</u>	reporting <u>2/</u>	expenditures <u>3/</u>
	Percent					
Corn	88	64	12	34	3	2
Cotton	34	12	72	87	1	1
Wheat	40	27	60	72	1	1
Sorghum	43	19	60	80	<u>4/</u>	1
Rice	10	1	96	99	1	<u>4/</u>
Other grain <u>5/</u>	56	40	43	59	2	1
Soybeans	72	46	27	51	2	3
Tobacco	98	74	5	26	--	--
Peanuts	46	24	62	75	1	1
Sugarbeets	61	36	40	62	10	2
Other field crops <u>5/</u>	40	19	70	80	3	1
Alfalfa	64	21	32	74	6	5
Other hay and forage <u>5/</u>	87	60	18	40	--	--
Pasture	42	16	56	75	2	9
Irish potatoes	42	19	83	77	2	4
Other vegetables	56	44	54	44	11	12
Citrus	99	94	5	2	3	4
Apples	50	20	39	71	11	9
Other deciduous fruit <u>5/</u>	72	57	24	32	20	11
Other fruit and nuts <u>5/</u>	69	63	30	35	3	2
Nursery and greenhouse	44	57	30	37	36	6
Summer fallow	67	49	36	51	--	--
All crops	70	35	34	63	3	2

-- = None reported.

1/ Excludes Alaska.

2/ Survey farms reporting custom pesticide services employing this type of application equipment as percentage of survey farms reporting custom pesticide services for all types of application equipment. May add to over 100 percent due to use of more than one type of custom equipment by individual farmers.

3/ Expenditures for custom application charges employing this type of application equipment as percentage of expenditures for custom application charges for all types of application equipment.

4/ Less than 0.5 percent.

5/ Crops included in this category are listed in the appendix.

Table 15.--Percentage distribution, by region, of farms using custom pesticide service and of expenditures for application charges (not including materials), by type of application equipment, 1971 1/

Region	Type of application equipment					
	Ground (surface operated)		Fixed wing aircraft		Rotary wing aircraft	
	Farms	Custom	Farms	Custom	Farms	Custom
	reporting <u>2/</u>	expenditures <u>3/</u>	reporting <u>2/</u>	expenditures <u>3/</u>	reporting <u>2/</u>	expenditures <u>3/</u>
	Percent <u>4/</u>					
Northeast	89	80	11	16	<u>4/</u>	4
Lake States	84	65	14	29	8	6
Corn Belt	91	80	13	18	2	2
Northern Plains	46	31	60	69	1	1
Appalachian	90	68	14	30	<u>4/</u>	1
Southeast	67	47	35	50	<u>4</u>	3
Delta States	16	3	88	97	1	<u>4/</u>
Southern Plains	30	15	83	83	1	<u>2</u>
Mountain	38	13	69	85	2	2
Pacific	60	36	54	60	8	4
All Regions	70	35	34	63	3	2

1/ Excludes Alaska.

2/ Survey farms reporting custom pesticide services employing this type of application equipment as a percentage of survey farms reporting custom pesticide services for all types of application equipment. May add to over 100 percent due to use of more than one type of custom equipment by individual farmers.

3/ Expenditures for custom application charges employing this type of application equipment as a percentage of expenditures for custom application charges for all types of application equipment.

4/ Less than 0.5 percent.

80 percent was applied by fixed-wing aircraft on farms grossing \$100,000 or over, compared with 26 to 35 percent on farms grossing under \$10,000 (table 16). Conversely, ground equipment applied 21 percent of the materials on the largest farms compared with 65 to 72 percent on farms grossing under \$10,000.

Most Custom Pesticide Materials are Sprayed On

Pesticide materials were classified into five major types: Dusts, sprays, granules, pesticides mixed with fertilizer, and other. 5/

Sprays are the predominant form of pesticides used in custom application. In the 3 survey years of 1964, 1966, and 1971, sprays accounted for about 88 percent of the expenditures for custom-applied pesticide materials (table 17). The proportion of expenditures for pesticides in the dust form decreased from about 9 percent in 1964 and 1966 to 3 percent in 1971. As with dusts, the proportion of expenditures for pesticides in the granular form, mixed with fertilizer, and other forms of pesticides (foams, baits, and so forth) indicated only minimal use.

Use of sprays predominates for all crops. According to expenditures in 1971, about 95 percent or more of custom pesticide materials for the following crops or crop categories were applied in spray form--wheat, other grains, tobacco, other field crops, alfalfa, other hay and forage, pasture, Irish potatoes, citrus, apples, and summer fallow (table 18).

Sprays accounted for from 72 percent of custom expenditures in the Appalachian region to 95 percent in the Delta States and Mountain regions (table 19). Dusts were from 10 to 20 percent of the material expenditures in the Appalachian and Southeast regions, where fungicides in dust form are important for use on peanuts.

On farms grossing over \$2,500, sprays accounted for about 90 percent of the custom pesticide material expenditures (table 20). On farms grossing less than \$2,500, sprays accounted for 75 percent, dust about 20 percent, and pesticide mixed with fertilizer about 5 percent.

Custom Pesticide Services for Livestock Used to Minimal Extent

In 1971, expenditures for custom-applied pesticide materials accounted for less than 3 percent of the total \$44 million spent on pesticide materials

5/ Dusts are dry materials purchased at field strength and applied in dry form. Sprays are applied in a liquid medium. They are usually purchased either as emulsions or flowables or wettable powders and mixed with water before application. Emulsions are the most common form for many pesticide products, due to reduced dangers in mixing and ease of combining with water. Granules are dry materials which have been aggregated into pellets. Those pesticides "mixed with fertilizer" are generally herbicides that are used as pre-emergence treatments. All other pesticides were grouped into a category of "other." This group includes foams, baits, strips, aerosols, and rubs.

Table 16.--Percentage distribution, by gross sales class, of farms using custom pesticide services and of expenditures for application charges (not including materials), by type of application equipment, 1971 ^{1/}

Gross sales class	Type of equipment					
	Ground (surface)		Fixed wing aircraft		Rotary wing aircraft	
	Farms	Custom	Farms	Custom	Farms	Custom
	reporting ^{2/}	expenditures ^{3/}	reporting ^{2/}	expenditures ^{3/}	reporting ^{2/}	expenditures ^{3/}
				Percent		
Less than \$2,500	90	71	10	26	2	3
\$2,500-4,999	88	72	13	27	2	2
\$5,00-9,999	83	65	22	35	--	--
\$10,000-19,999	71	54	31	44	4	2
\$20,000-39,999	64	38	43	60	3	2
\$40,000-99,999	54	31	52	66	3	3
\$100,000 and over	41	21	71	77	4	2
All Regions	70	35	34	62	3	2

-- = None reported.

^{1/} Excludes Alaska.

^{2/} Survey farms reporting custom pesticide services employing this type of application equipment as a percentage of survey farms reporting custom pesticide services for all types of application equipment. May add to over 100 percent due to use of more than one type of custom equipment by individual farmers.

^{3/} Expenditures for custom application charges employing this type of application equipment as a percentage of expenditures for custom application charges for all types of application equipment.

Table 17.--Percentage distribution of expenditures for custom-applied pesticide materials by form of pesticide, 1964, 1966, and 1971 1/

Year	Form of pesticide				
	Dust	Spray	Granular	Mixed with fertilizer	Other <u>2/</u>
	Percent				
1964	10	88	1	<u>3/</u>	1
1966	8	87	4	1	<u>3/</u>
1971	3	88	5	2	1

1/ Excludes Alaska and Hawaii in 1964 and 1966 and excludes Alaska in 1971.

2/ Includes foams, baits, strips, aerosols, rubs, and so forth.

3/ Less than 0.5 percent.

Table 18.--Percentage distribution by crop category, of expenditures for custom-applied pesticide materials, by form of pesticide, 1971 1/

Crop category	Form of pesticide				
	Dust	Spray	Granular	Mixed with fertilizer	Other <u>2/</u>
	Percent				
Corn	2	87	6	5	<u>3/</u>
Cotton	4	82	2	<u>3/</u>	<u>1</u>
Wheat	1	95	4	<u>3/</u>	--
Sorghum	1	84	14	<u>2</u>	--
Rice	--	90	10	--	<u>3/</u>
Other grain <u>4/</u>	<u>3/</u>	95	5	<u>3/</u>	<u>1</u>
Soybeans	<u>2</u>	84	11	<u>3</u>	<u>3/</u>
Tobacco	2	98	--	--	--
Peanuts	15	84	1	--	--
Sugarbeets	8	64	7	9	12
Other field crops <u>4/</u>	1	97	2	<u>3/</u>	--
Alfalfa	<u>3/</u>	97	2	--	1
Other hay and forage <u>4/</u>	--	100	--	--	--
Pasture	--	99	<u>3/</u>	--	--
Irish potatoes	1	95	<u>4</u>	<u>3/</u>	<u>3/</u>
Other vegetables <u>4/</u>	9	82	1	<u>2</u>	<u>6</u>
Citrus	4	94	2	--	<u>3/</u>
Apples	--	100	--	--	--
Other deciduous fruit <u>4/</u>	34	66	--	--	--
Other fruits and nuts <u>4/</u>	10	87	1	1	1
Nursery and greenhouse	32	68	--	--	--
Summer fallow	--	100	--	--	--
All crops	3	89	5	2	1

-- = None reported.

1/ Excludes Alaska.

2/ Includes foams, baits, strips, rubs, and so forth.

3/ Less than 0.5 percent.

4/ Crops included in this category are listed in the appendix.

Table 19.--Percentage distribution , by region, of expenditures for custom-applied pesticide materials for crops, and by form of pesticide, 1971 1/

Region	Form of pesticide				
	Dust	Spray	Granular	Mixtures	Other
	<u>Percent</u>				
Northeast	1	85	<u>2/</u>	14	<u>3/</u>
Lake States	2	85	<u>12</u>	1	--
Corn Belt	<u>3/</u>	89	5	6	<u>3/</u>
Northern Plains	--	91	6	1	--
Appalachian	18	72	1	9	--
Southeast	11	87	1	1	--
Delta States	<u>3/</u>	95	4	--	<u>3/</u>
Southern Plains	1	92	7	--	--
Mountain	1	95	4	--	<u>3/</u>
Pacific	8	83	6	1	<u>2</u>
All Regions	3	89	5	2	1

-- = None reported.

1/ Excludes Alaska.

2/ Includes foams, baits, strips, rubs, and so forth.

3/ Less than 0.5 percent.

Table 20.--Percentage distribution, by gross sales class, of expenditures for custom-applied pesticide materials for crops, by form of pesticide, 1971 1/

Gross sales class	Form of pesticide				
	Dust	Spray	Granular	Mixtures	Other <u>2/</u>
	<u>Percent</u>				
Less than \$2,500	18	75	1	6	--
\$2,500-4,999	1	90	6	3	--
\$5,000-9,999	3	88	4	4	1
\$10,000-19,999	2	91	3	4	1
\$20,000-39,999	3	89	6	2	<u>3/</u>
\$40,000-99,999	4	89	5	1	<u>1</u>
\$100,000 and over	3	89	5	1	2
Average all classes	3	89	5	2	1

-- = None reported.

1/ Excludes Alaska.

2/ Includes foams, baits, strips, rubs, and so forth.

3/ Less than 0.5 percent.

for livestock. Approximately \$3 million was spent on custom pesticide services including \$1.9 million for application and \$1.1 million for materials--an average of \$85 per farm.(table 21).

Beef cattle accounted for the largest custom service expenditures, about 60 percent of the total for livestock. On a per farm basis, poultry and dairy cattle producers had the largest average expenditures, \$141 and \$123, respectively. Beef cattle producers spent \$74 per farm.

The proportion of farms reporting custom-applied pesticides for livestock has changed very little over the past decade. In 1964 and 1966, 5 percent of the farms using pesticides on livestock had it custom-applied, compared to 3 percent in 1971 (table 22). Expenditures for custom-applied materials for livestock declined from about \$1.7 million in 1964 to \$1.1 million in 1971. On a per farm basis, custom material expenditures for all livestock averaged \$32 in 1971 compared to about \$25 in 1964 and 1966.

In 1971, about 35,000 farms reported custom pesticide services for livestock (table 23). The percentage of all farms using pesticides on livestock that employed custom services ranged from 6 percent for sheep ranches to 1 percent for dairies. Expenditures ranged from \$1.8 million for beef cattle to \$80,000 for sheep.

The Corn Belt and Northern Plains regions accounted for about 45 percent of the expenditures for pesticide services for livestock (table 24). About 16,500 farms in these two regions used custom services on livestock, nearly 50 percent of the U.S. total.

Expenditures for custom pesticide services for livestock is strongly influenced by size of farm. The largest farms (grossing \$100,000 or over) averaged about \$370 per farm and the smaller farms (grossing less than \$10,000) averaged \$35-\$45 per farm (table 25). Custom services per dollar of farm sales, however, is more for the smaller farms. One of the reasons that smaller farms account for relatively larger custom pesticide expenditures is that many of them are operated by part-time operators. Time needed for off-farm jobs makes use of custom services more feasible.

Custom Pesticide Services for Other Farm Uses are Minor

About 2 percent of the farmers custom pesticide dollars are spent for uses other than treatment of growing crops or livestock. These "other farm uses" include seed treatments, stored crops, buildings, seedbeds, transplants, and other miscellaneous noncrop and nonlivestock uses.

In 1971, custom pesticide services for "other farm uses" amounted to about \$7.5 million, or about \$18 per farm (table 26). Application charges were about 45 percent and materials costs about 55 percent of the \$7.5 million total.

Seed treatments and stored crops, and seedbeds and transplants accounted for over 70 percent of the custom expenditures for "other farm uses." Custom-applied materials for all "other farm uses" categories cost about \$4 million in 1966 and in 1971 (table 27).

Table 21.--Expenditures for custom pesticide services, by type of livestock, 1971 ^{1/}

Class of livestock	Total custom pesticide cost			Per farm custom pesticide cost		
	for application and material			for application and material		
	Application:	Cost of	Total	Application:	Cost of	Total
	charges	materials		charges	materials	
	--- 1,000 dollars ---			---- Dollars ----		
Dairy cattle	353	196	549	79	44	123
Beef cattle	1,071	720	1,791	44	30	74
Hogs	110	53	163	23	11	34
Sheep	59	20	79	59	12	71
Poultry	158	59	217	103	38	141
Other livestock ^{2/}	108	64	172	52	31	83
All classes	1,859	1,112	2,971	53	32	85

^{1/} Excludes Alaska.^{2/} Includes horses, rabbits, mink, and other commercially produced livestock that were not enumerated separately.Table 22.--Extent of use and expenditures for custom-applied pesticide materials for livestock, 1964, 1966, and 1971 ^{1/}

Class of livestock	Farms reporting			Expenditures for custom-applied					
	custom service ^{2/}			pesticide materials					
	1964	1966	1967	All farms ^{3/}			Per farm ^{4/}		
	1964	1966	1967	1964	1966	1971	1964	1966	1971
	--- Percent ---			--- 1,000 dollars ---			--- Dollars ---		
Dairy cattle	5	3	1	440	263	196	16	16	44
Beef cattle	3	5	3	720	987	720	23	27	30
Hogs	1	2	2	172	102	53	15	14	11
Sheep	5	15	6	132	59	20	35	10	12
Poultry	1	6	3	226	490	59	47	68	38
Other livestock ^{5/}	<u>6/</u>	1	4	<u>6/</u>	6	64	<u>6/</u>	9	31
All livestock classes	5	5	3	1,690	1,907	1,112	25	26	32

^{1/} Excludes Alaska and Hawaii in 1964 and 1966 and excludes Alaska in 1971.^{2/} Survey farms reporting custom pesticide services for livestock as a percentage of farms reporting pesticide use for livestock.^{3/} Estimated expenditures for all U.S. farms.^{4/} Expenditures per farm reporting custom pesticide service for specified classes of livestock.^{5/} Includes horses, rabbits, mink, and other commercially produced livestock that were not enumerated separately.^{6/} Data for other livestock not included in survey for 1964.

Table 23.--Extent and cost of custom pesticide services (application and materials) for selected classes of livestock, 1971 1/

Class of livestock	: Farms reporting	: Expenditures	: Expenditures	
	: custom service	: for custom	: per	
	: for livestock <u>2/</u>	: services	: farm <u>3/</u>	
	: <u>1,000</u>	<u>Percent 4/</u>	<u>1,000 dollars</u>	<u>Dollars</u>
Dairy cattle	4.5	1	549	123
Beef cattle	24.3	3	1,791	74
Hogs	4.7	2	163	35
Sheep	1.7	6	79	71
Poultry	1.5	3	217	141
Other livestock <u>5/</u>	2.1	4	172	83
All classes	<u>6/34.9</u>	3	2,971	85

1/ Excludes Alaska.

2/ Estimated expenditures for all farms in the 49 States.

3/ Expenditures per farm reporting custom pesticide expenditures for livestock.

4/ Survey farms reporting custom pesticide services for livestock as a percentage of farms reporting pesticide use for livestock.

5/ Includes horses, rabbits, mink, and other commercially produced livestock that were not enumerated separately.

6/ Total includes each farm only once and thus does not reflect the fact that some farms reported custom pesticide services for more than one type of livestock.

Table 24.--Extent of use and expenditures for custom pesticide services (application and materials) for livestock, by regions, 1971 1/

Region	Farms reporting custom service for livestock	Expenditures for custom services	Expenditures per farm <u>2/</u>	
	<u>1,000</u>	<u>Percent</u>	<u>1,000 dollars</u>	<u>Dollars</u>
Northeast	2.2	2	127	58
Lake States	3.8	2	227	59
Corn Belt	9.1	<u>4/</u>	700	76
Northern Plains	7.4	<u>7</u>	622	84
Appalachian .....	.7	<u>4/</u>	62	91
Southeast	1.9	<u>2</u>	279	148
Delta States	4.0	5	116	29
Southern Plains	1.8	1	313	178
Mountain	3.5	7	222	63
Pacific .....	.4	1	303	728
All Regions	<u>5/34.9</u>	3	2,971	85

1/ Excludes Alaska. Includes dairy, beef, hogs, sheep, poultry and other livestock such as rabbit and mink.

2/ Average per farm reporting use of custom pesticide services for livestock.

3/ Survey farms reporting custom pesticide services for livestock as a percentage of farms reporting pesticide use for livestock.

4/ Less than 0.5 percent.

5/ Total includes each farm only once and thus does not reflect the fact that some farms reported custom pesticide services for more than one type of livestock.

Table 25.--Extent of use and cost of custom pesticide services (application and materials) for livestock by gross sales classes of farms, 1971 1/

	:	Farms reporting	:	Expenditures	:	
Gross sales class	:	custom services	:	for custom	:	Expenditure per
	:	for livestock	:	services <u>2/</u>	:	farm <u>3/</u>
	:		:		:	
	:	<u>1,000</u>	:	<u>Percent 4/</u>	:	<u>1,000 dollars</u>
	:		:		:	<u>Dollars</u>
Less than \$2,500	:	6.1	:	2	:	273
\$2,500-4,999	:	2.5	:	2	:	81
\$5,000-9,999	:	3.8	:	3	:	165
\$10,000-19,999	:	4.2	:	3	:	294
\$20,000-39,999	:	9.2	:	5	:	676
\$40,000-99,999	:	6.3	:	5	:	477
\$100,000 or more	:	2.7	:	8	:	1,005
	:		:		:	
All sales classes	:	<u>5/34.9</u>	:	3	:	2,971
	:		:		:	

1/ Excludes Alaska. Includes dairy and beef cattle, hogs, sheep, poultry and other livestock such as rabbit and mink.

2/ Estimated expenditures for all farms in the 49 States.

3/ Expenditures per farmer included in the survey who used custom pesticide services for livestock.

4/ Survey farms reporting custom pesticide services for livestock as a percentage of farms reporting pesticide use for livestock.

5/ Total includes each farm only one and thus does not reflect the fact that some farms reported custom pesticide services for more than one type of livestock.

Table 26.--Expenditures for custom pesticide services for uses other than on crops and livestock, 1971 1/

Other farm uses	Custom pesticide expenditures:			Per farm pesticide expenditures		
	Application: charges	Cost of materials:	Total <u>2/</u>	Application: charges	Cost of materials:	Total <u>2/</u>
	--- <u>1,000 dollars</u> ---			--- <u>Dollars</u> ---		
Seed treatments and stored crops	970	1,388	2,358	7	10	17
Buildings	87	37	124	1	--	1
Seedbeds and transplants	1,306	1,738	3,044	8	11	19
Miscellaneous noncrop uses	994	964	1,958	13	13	26
Total <u>2/</u>	3,356	4,127	7,484	8	10	18

-- = None reported.

1/ Excludes Alaska.

2/ Totals may not agree with details because of rounding.

Table 27.--Extent of use and expenditures for custom-applied pesticide materials (application costs not included) for use other than on crops and livestock, 1971 ^{1/}

Year	: Expenditures for custom pesticide materials applied to					
	: total pesticide	: Seed and	:	: Seedbeds	: Miscellaneous	: Total
	: expenditure	: stored	: Buildings	: and	: noncrop	: other
	: custom-applied	: crops	:	: transplants	: usage	: usage
	:-- <u>Percent</u> --			--- <u>1,000 dollars</u> ---		
1966	29	2,990	16	452	479	3,937
1971	27	1,388	37	1,738	964	4,127

^{1/} Excludes Alaska and Hawaii in 1966 and Alaska in 1971. Data on expenditures for noncrop and nonlivestock use not reported in the 1964 survey.

Expenditures for custom-applied pesticide materials in the Pacific region accounted for 80 percent of the total material expenditures (table 28). Custom expenditures were moderately important in the Appalachian region where most went for treating tobacco seedbeds.

For farms grossing \$100,000 and over, about 40 percent of the total pesticide expenditures were for custom-applied materials compared to less than 20 percent for farms grossing under \$10,000 (table 29). Farms grossing \$10,000 or over accounted for about 98 percent of the \$4 million spent on custom materials expenditures.

REGULATION CHANGES INDICATE EXPANSION OF CUSTOM PESTICIDE SERVICES

Use of custom-applied pesticides may be substantially influenced by recent legislation on the Federal Environmental Pesticide Control Act of 1972 (FEPCA) passed in October 1972. The primary purpose of the Act, which becomes effective in October 1976, is to amend the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) so as to change it from a labeling act into a use, classification, and regulatory act. This statute controls the manufacture, distribution, and use of pesticides. One of the provisions of FEPCA is to classify pesticides into two categories--general use and restricted use. The pesticides considered highly hazardous to the applicator or to the environment will be placed in the more dangerous restricted use category. Pesticides in the restricted use category could only be applied by or under the direct supervision of licensed pesticide applicators. There will be two categories of licensed applicators--commercial and private. Private pesticide applicators are most likely to be farmers. All applicators are certified and required to exhibit satisfactory knowledge and ability to safely apply pesticides. But private applicators' knowledge and ability are likely to be limited to the problems associated with the commodities they produce.

The implications for farmers are quite clear. Only those meeting these standards could be certified. Larger farm operators and custom pesticide applicators are more likely to be certified. Others, including the smaller farm operators, would need to purchase their pesticide services.

Table 28.--For noncrop and nonlivestock uses, custom pesticide materials expenditures as a proportion of total pesticide material expenditures for custom materials and expenditures for custom pesticide materials, by type of usage and region, 1971 ^{1/}

Farm production region	Proportion of total pesticide material expenditures for custom application to--					Expenditures for pesticide material custom-applied to--				
	Seed	Build-	Seed beds	Miscel-	Total	Seed	Build-	Seed beds	Miscel-	Total
	and	ings	and	aneous	"other"	and	ings	and	aneous	"other"
	stored	ings	trans-	noncrop	usage ^{3/}	stored	ings	trans-	noncrop	usage ^{3/}
	crops		plants	uses		crops		plants	uses	
	--- Percent ---					--- 1,000 dollars ---				
Northeast	1	--	8	--	2	6	--	13	--	19
Lake States	6	6	--	4	4	8	12	--	18	38
Corn Belt	15	3	24	4	8	60	6	16	24	105
Northern Plains ...	41	2	--	60	40	553	3	--	108	664
Appalachian	--	2	29	--	24	--	2	906	--	908
Southeast	2	1	18	28	8	28	^{2/}	113	22	163
Delta	16	3	--	30	21	33	1	--	61	95
Southern Plains ...	4	4	--	2	3	16	3	--	5	24
Mountain	52	--	--	16	40	524	--	--	77	601
Pacific	72	50	84	80	80	160	11	690	649	1,510
United States ...	23	4	35	30	27	1,388	37	1,738	964	4,127

-- = None reported.

^{1/} Excluding Alaska.

^{2/} Less than \$500.

^{3/} Totals may not agree with details of rounding.

Table 29.--For noncrop and nonlivestock uses, the proportion of total pesticide material expenditures for custom materials, and the expenditures for custom pesticide materials, by type of usage and gross sales class of farm, 1971 ^{1/}

Gross sales per farm	Proportion of total pesticide material expenditures for custom application to--					Expenditure for pesticide materials custom-applied to--				
	Seed	Seed	Seed	Miscel-	Total	Seed	Seed	Seed	Miscel-	Total
	and stored crops	Build- ings	and trans- plants	and noncrop uses	"other" usage ^{3/}	and stored crops	Build- ings	and trans- plants	and noncrop uses	"other" usage ^{3/}
	--- Percent ---					--- 1,000 dollars ---				
Less than \$2,500	18	6	2	2	4	8	12	5	3	27
\$2,500-4,999	19	--	7	10	11	37	--	21	11	68
\$5,500-9,999	21	--	10	19	16	118	--	69	69	256
\$10,000-19,999	54	^{2/}	31	42	39	415	1	280	300	994
\$20,000-39,999	24	⁵	44	22	30	328	8	490	131	957
\$40,000-99,999	17	5	47	20	22	447	10	360	132	949
\$100,000 and over ...	8	5	58	51	41	37	6	514	318	876
Average all sales classes	23	4	35	30	27	1,388	37	1,738	964	4,127

-- = None reported.

^{1/} Excludes Alaska.

^{2/} Less than 0.5 percent.

^{3/} Totals may not agree with details because of rounding.

Individual Crops

Corn
 Cotton
 Wheat
 Sorghum
 Rice
 Soybeans
 Tobacco
 Peanuts
 Sugarbeets
 Alfalfa
 Pasture
 Irish potatoes
 Citrus
 Apples
 Nursery and greenhouse
 Summer fallow

Other Grains

Oats
 Mixed grains
 Barley
 Rye

Other Field Crops

Grass and hayseed
 Buckwheat
 Castorbeans
 Hops
 Lentils
 Millet
 Mung beans
 Peppermint
 Spearmint
 Rutabagas
 Sesame
 Spelt
 Sunflowers
 Velvetbeans
 Dry beans
 Dry field peas
 Flax
 Popcorn
 Broomcorn
 Cowpeas
 Sugarcane

Other Hay and Forage

All hay and forage other than
 alfalfa

Other Vegetables

Sweetpotatoes
 Cabbage
 Carrots
 Celery
 Lettuce
 Onions
 Tomatoes
 Watermelons
 Sweet corn
 Snap beans
 Spinach
 Artichokes
 Asparagus
 Broccoli
 Cauliflower
 Cucumbers
 Beets
 Green peas
 Other vegetables

Other Deciduous Fruit

Peaches
 Pears
 Cherries
 Apricots
 Plums
 Prunes
 Nectarines

Other Fruits and Nuts

Grapes
 Avocados
 Figs
 Blackberries
 Blueberries
 Boysenberries
 Currants
 Gooseberries
 Loganberries
 Raspberries
 Strawberries
 Cranberries
 Almonds
 Filberts
 Pecans
 Walnuts
 Olives
 Tung nuts

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U.S. DEPARTMENT OF AGRICULTURE

This publication reports research involving pesticides. It does not contain recommendations for their use, nor does it imply that the uses discussed here have been registered. All uses of pesticides must be registered by appropriate State and/or Federal agencies before they can be recommended.

CAUTION: Pesticides can be injurious to humans, domestic animals, desirable plants, and fish or other wildlife -- if they are not handled or applied properly. Use all pesticides selectively and carefully. Follow recommended practices for the disposal of surplus pesticides and pesticide containers.